Section 3-6

Scale Changes of Data

Warm-up

From 1982-84 to 1996, in US cities, prices increased at the following average rates:

Food: 55.8% Medical Care: 126.7% Energy Costs: 8.7%

Estimate the 1996 prices of the following items based on the 1982-84 prices.

1. A box of cereal at $2.29 *$3.57*
2. A gallon of gas at $1.159 *$1.26*
3. A hospital stay at $450 for one night *$1020.15*
4. A gallon of milk at $1.75 *$2.73*

Scale Change (on a data set): On a data set $\{x_1, x_2, \ldots, x_n\}$, a transformation which maps each element x_i onto ax_i, where $a \neq 0$

Scale Factor: The number ($a \neq 0$) that you multiply by to cause the change to the data

Scale Image: Where the data point ends up after a scale change

Scaling or Rescaling: Applying a scale change to a data set

Example 1

Matt Mitarnowski earned the following tips (in dollars) per day for a stretch of 10 days, where he worked for 6 hours each day:

41 51 55 13 25 23 99 23 53 82

Suppose he was to work for 12 hours on these days instead, earning tips at the same rate.

a. Find the scaled tips (in dollars)

We need to multiply each data point by 2

82 102 110 26 50 46 198 46 106 164

Example 1

b. Find the mean, median, range, and standard deviation of both sets.

	Preimage:	Image:
Mean:	46.5	93
Median:	46	92
Range:	86	172
Standard Deviation:	27.63	55.26

Theorem (Measures of Center): Each measure of spread is multiplied by the scale factor that is applied to the set

Theorem (Measures of Spread): When each data points has a scale factor a applied to it, then:

1. Variance is a^2 times the original variance
2. Standard deviation is $|a|$ times the original standard deviation
3. Range is $|a|$ times the original range

Example 2

The workers at the local bublegum factory have a mean salary of $30,000 with a standard deviation of $4,000. If each worker is given a 5% raise, what will be the new mean salary and standard deviation?

The mean will be changed by 5%

30,000(1.05) = $31,500

The standard deviation will be 5% greater

4,000(1.05) = $4,200

Example 3

To give an approximate conversion from miles to kilometers, you can multiply the number of miles by 1.61. Suppose data is collected about the number of miles that cars can go on a tank of gas. What will be the effect of changing from miles to kilometers on:

a. the median of the data? Multiplied by 1.61

b. the variance of the data? Multiplied by 2.5921

c. the standard deviation of the data? Multiplied by 1.61

Thought Question

How might this information be useful in the real world?

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Homework

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